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Title: BOM: THE NEXT GENERATION OF HIGH PERFORMANCE EXPLOSIVES

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Tech Snapshot

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BOM: THE NEXT GENERATION OF HIGH PERFORMANCE EXPLOSIVES

SUMMARY

The EPA has declared phase-out of Trinitrotoluene (TNT) a priority due to toxicity concerns. LANL and the Army Research Laboratory created a melt-castable next generation high performance explosive to replace TNT. They invented bis(1,2,4-oxadiazole)bis(methylene) dinitrate, or BOM, a higher-performing, safer replacement, which is 50% more energetic than TNT. BOM is less toxic to produce and use than TNT. Unlike competitors, BOM requires no performance-enhancing additives. BOM could replace TNT in a variety of civilian and military applications. BOM has been synthesized at the multi-kilogram scale.

MARKET

BOM has superior physical properties to replace TNT in a wide variety of civilian and military applications, such as construction, demolition, underwater blasting, mining, oil well perforation, or military munitions. BOM achieves the EPA goal of removing TNT and the toxicity that TNT introduces to humans and the environment. BOM provides greater explosive energy per unit volume than TNT. BOM can be melt-cast with steam heat, enabling low-energy processing.

BENEFITS

BOM is a viable replacement for the explosives TNT or Composition B. BOM has enhanced explosive performance, safety, and it does not have the toxicity of TNT to people and the environment. BOM is a standalone explosive, meaning that the addition of additives is not required to boost performance.

- Explosive performance is 50 % better than that of TNT
- Synthesized under milder conditions without producing the toxic waste of TNT
- Safer to process than TNT
- Avoids the human toxicity of TNT
- Melt-castable processing with steam heat enables low-energy production
- Exceeds the industry benchmark for safety
- Can be used without additives to boost explosive performance

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WHY WE ARE BUILDING BOM: THE NEXT GENERATION OF HIGH PERFORMANCE EXPLOSIVES

The United States EPA has declared phase-out of TNT as a priority due to its human and environmental toxicity. BOM avoids the problem of TNT being harmful to the environment by being manufactured by a less hazardous process and avoiding production of nitrated aromatic compounds altogether. It also avoids TNT's human toxicity during processing and use. BOM is 50% higher performing than TNT and is safer to work with.

WHAT'S BEHIND OUR TECHNOLOGY

BOM is 50% higher in performance than TNT. BOM is also higher performing than the most powerful TNT formulations (Composition B) and it is at least as safe. Other TNT replacement materials (e.g., 2,4-dinitroanisole, or DNAN) do not exceed the performance of TNT. BOM's chemical composition and structure result in its superior explosive properties. BOM has more oxygen and nitrogen than TNT does. The abundance of oxygen in BOM enables more complete combustion. BOM has more higher-density atoms (nitrogen and oxygen) and fewer lower-density atoms (carbon and hydrogen), enabling its overall crystal density and explosive performance to be higher than that of TNT.

OUR COMPETITIVE ADVANTAGES

BOM produces less hazardous waste and no harmful nitrated aromatic byproduct, which TNT does. BOM's much lower vapor pressure when melted, compared with TNT and other common explosives in liquid form, reduces worker exposure. BOM surpasses all of its competitors in explosive performance, yet it exceeds the industry benchmarks for safety. BOM has high crystal density, effective energy extraction, and excellent detonation velocity and pressure. Additives are not needed to boost performance, whereas TNT requires the addition of a toxic chemical called RDX to enhance performance.

OUR TECHNOLOGY STATUS

Scientists at the Army Research Laboratory in Aberdeen, Maryland have successfully scaled up BOM production to the kilogram scale. A partner to further develop cost-effective methods to produce BOM at industrial scale is desired. Such development may be pursued through a licensing agreement of through collaborative R&D under a CRADA.

PUBLICATIONS AND IP

"Bis(1,2,4-oxadiazole)bis(methylene) Dinitrate: A High-Energy Melt Castable Explosive and Energetic Propellant Plasticizing Ingredient" Johnson, E. C.; Sabatini, J. J.; **Chavez, D. E.**; Sausa, R. C.; Byrd, E. F. C.; Wingard, L. A.; Guzman, P. E. *Org. Process. Res. Dev.* **2018**, 22, 6, 736-740.

"Density Functional Theory and Experimental Studies of the Molecular, Vibrational and Crystal Structure of Bis-Oxadiazole-Bis-methylene Dinitrate (BODN)" Sausa, R. C.; Batyrev, I. G.; Pesce-Rodrigues, R. A.; Byrd, E. *J. Phys. Chem. A*, **2018**, 122, 46, 9043-9053.

A provisional patent application has been filed.